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PLANNING BOARD  
GRAFTON, MA

**EXHIBIT 4** TRAFFIC  
IMPACT  
STUDY

**MJ's Market**

**TRAFFIC IMPACT ANALYSIS FOR THE  
MJ'S MARKET  
GRAFTON, MASSACHUSETTS**

**SUBMITTED TO:  
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**SUBMITTED BY:  
PARE CORPORATION  
8 BLACKSTONE VALLEY PLACE  
LINCOLN, RI 02865**

**OCTOBER 2019**



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## **INTRODUCTION**

The following represents the traffic study completed for the development of MJ's Market medicinal and recreational cultivation and retail facility to be located at 13 Centennial Drive in Grafton, Massachusetts. The proposed facility will be located in the unoccupied building at 13 Centennial Drive and is expected to employ 10 full-time workers and 30 part-time workers. MJ's Market will operate Monday through Saturday 10:00 a.m. to 11:00 p.m. and Sunday 12:00 p.m. to 9:00 p.m.

The proposed facility will maintain the existing driveway on Centennial Drive, which connects to Centech Boulevard/Pine Street. This road network serves a large portion of Centech Park, consisting of industrial and commercial uses. The site for the proposed facility is approximately 1.8 acres.

Presented within are existing conditions in the vicinity of the project site, a safety analysis of the study area, and proposed mitigation measures and/or recommendations, as necessary. A locus map of the study area is provided in Figure 1 and the proposed site layout is shown in Figure 2.

Weekday evening and weekend peak periods for Existing (2019) and Future (2026) No-Build conditions were analyzed. Future traffic conditions with and without the proposed development were projected. The future (2026) conditions analyzed were projected seven years from the existing conditions.

Finally, the study evaluates the results of the Future (2026) Build condition analysis to determine the impact of the proposed development on the adjacent transportation network and any necessary mitigation.

## **DATA COLLECTION**

Manual turning movement counts (MTMCs) were completed on June 14, 2017 from 7:00 a.m. to 9:00 a.m. and from 4:00 p.m. to 6:00 p.m. and Saturday September 28, 2019 from 11:00 a.m. to 1:00 p.m. at the following intersections:

- Centech Boulevard/Pine Street at Centennial Drive
- Westboro Road at Pine Street

Counts from 2017 were taken as a part of a Traffic Impact Analysis (TIA) Pare conducted in 2017 for Nature's Remedy, a proposed marijuana distribution facility on Millennium Drive. The volumes from 2017 have been inflated using a 2% annual population growth to reflect 2019 volumes.

Crash data for the roadway network in the vicinity of the project site was extracted from the MassDOT crash portal. This data encompasses the most recent three-year period available, from August 2016 through August 2019.

A field review of the study area was conducted, with geometric measurements and other field observations recorded at the significant intersections in the vicinity of the project site. The information obtained was used in the analysis of the study area intersections.

The Town of Grafton Planning Department was contacted to determine if there are currently any developments proposed within the Town whose trip generation information should be included in the facility study.



● = Study Intersection



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**Figure 1**  
**Locus Map**  
 MJ's Market  
 Grafton, MA



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## **EXISTING ROADWAY CONDITIONS**

The study area for the proposed medicinal and recreational marijuana facility is defined as the significant roadways and intersections in the vicinity of the site that may be impacted by the construction of the new facility. Listed below are the roadways and intersections included in the study area.

### **Study Area Roadways:**

1. Centennial Drive
2. Centech Boulevard/Pine Street
3. Westboro Road (Route 30)

### **Study Area Intersections:**

1. Centech Boulevard/Pine Street at Centennial Drive
2. Westboro Road (Route 30) at Pine Street

### **Centennial Drive**

Centennial Drive, which provide access to the proposed site, is classified as a local road under Town jurisdiction. Centennial Drive runs east/west and has an approximate curb-to-curb width of 20 feet per direction, separated by a 6-foot wide grassed median. A 4-foot wide asphalt sidewalk runs along the south side of Centennial Drive. Land use along Centennial Drive is commercial and institutional.

### **Centech Boulevard/Pine Street**

Centech Boulevard/Pine Street runs in the north/south direction and is classified as an urban collector under Town jurisdiction. Within the study area, Centech Boulevard/Pine Street has an approximate 27-foot curb-to-curb width with sidewalk located on the west side of the street. The roadway consists of one 12.5-foot wide travel lane in each direction with 1-foot wide shoulders. There is no posted speed limit along Centech Boulevard/Pine Street within the study area, and therefore a de facto speed limit of 30 miles per hour is assumed. Land use along Centech Boulevard/Pine Street is generally commercial and institutional.

### **Westboro Road (Route 30)**

Westboro Road (Route 30) runs in the east/west direction and is classified as an urban minor arterial and is under Town jurisdiction. Within the study area, Westboro Road has an approximate 30-foot edge-to-edge width with sidewalk located on the north side of the street starting at the intersection with Pine Street and continuing eastward. The roadway consists of one 12-foot wide travel lane in each direction with 3-foot wide shoulders. The study area limits of Westboro Road fall within a 30 mile per hour posted speed limit zone. Land use along Westboro Road is generally residential, with a few scattered commercial uses.

### **Centech Boulevard/Pine Street at Centennial Drive**

The intersection of Centech Boulevard/Pine Street and Centennial Drive operates as a three-legged unsignalized intersection. Centech Boulevard forms the north leg, Pine Street forms the south leg and Centennial Drive forms the west leg of the intersection. Centech Boulevard and Pine Street operate freely while Centennial Drive is under stop control. There is access from the east side of the intersection to a government facility; however it is gated off and designated for





authorized vehicles only. No vehicles were observed using the drive during the field review or traffic counts.

At the intersection, Centech Boulevard/Pine Street consists of one 12.5-foot travel lane in each direction with 1-foot wide shoulders. The western leg along Centennial Drive is 20 feet wide in each direction with no lane delineation, separated by a 6-foot

wide grassed median. Sidewalks are present on the west side of Centech Boulevard/Pine Street and along the south side of Centennial Drive. However, there is no crosswalk present at the intersection.

#### Westboro Road (Route 30) at Pine Street

The intersection of Pine Street and Westboro Road (Route 30) forms a three-legged unsignalized intersection. Pine Street forms the north leg of the intersection and Westboro Road forms the east and west legs. Both approaches along Westboro Road operate freely while Pine Street is under stop control for its left-turn movement and yield control for its channelized right-turn movement.



At the intersection, Pine Street consists of one 34-foot travel lane in the northbound direction with 1-foot shoulders, a 13-foot wide southbound left-turn lane with 1-foot shoulders, and an 18-foot wide channelized southbound right-turn lane with 1-foot shoulders. The western leg of Westboro Road (Route 30) consists of a 12-foot wide travel lane in each direction with 2-foot shoulders, and a 12-foot wide eastbound left-turn lane. The eastern leg of Westboro Road (Route 30) consists of a 12-foot wide travel lane in each direction with 2-foot shoulders, separated by a 12-foot wide striped gore. Sidewalks are present on the north side of Westboro Road from just west of Pine Street continuing eastward, and along the west side of Pine Street. A crosswalk is present across the Pine Street approach to the intersection.

The Grafton Massachusetts Bay Transportation Authority (MBTA) train station is located just north of the Westboro Road at Pine Street intersection. Because of the proximity of the train station a large volume of commuter traffic is experienced at this intersection during the morning and afternoon peak hours.

#### EXISTING TRAFFIC VOLUMES

Based on the traffic counts completed, the weekday p.m. peak hour at the study area intersections occurred between 4:45 p.m. and 5:45 p.m. The weekend peak hour occurred between 11:15 a.m. to 12:15 p.m. at the intersection of Pine Street and Westboro Road (Route 30) and 12:00 p.m. to



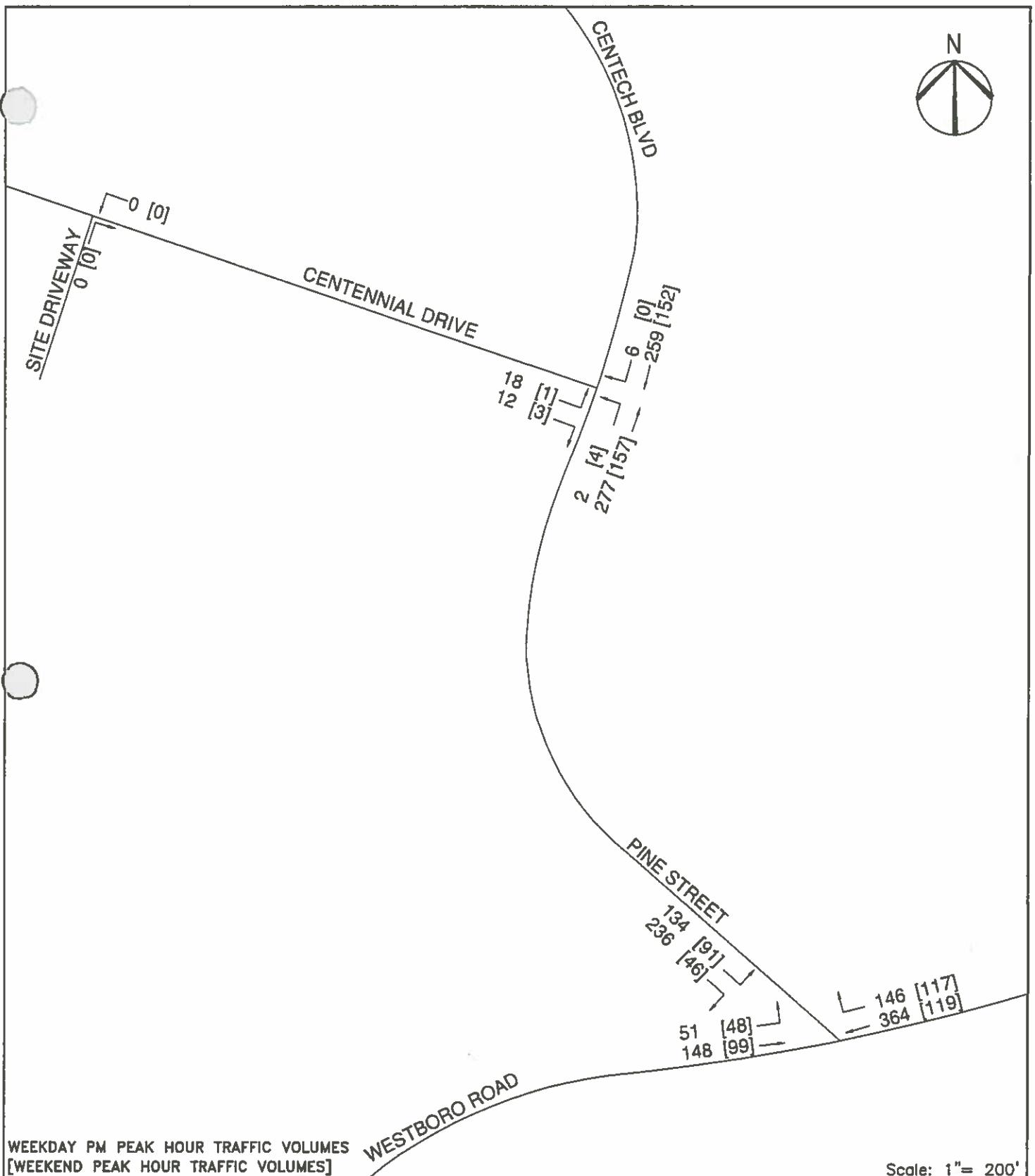
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1:00 p.m. at the intersection of Pine Street/Centech Boulevard and Centennial Drive. Since the intersections are unsignalized and therefore not coordinated, the peak hour identified for each location was utilized to produce a conservative analysis. Due to the proposed hours of operations for MJ's Market, volumes from the proposed site will not coincide with the adjacent roadways a.m. peak hour; therefore, the a.m. peak hour was not analyzed.

The data collected was also reviewed with respect to seasonal demands. Monthly data trends from the nearest MassDOT count stations (#307 and #3896) indicate that there are minor peaks in monthly volumes in the months of June, July and August. Additionally, all local schools were in normal session the days counts were completed. For these reasons, no seasonal adjustments were applied to the count data.

Copies of all count data are provided in Appendix A. Existing p.m. peak hour and weekend peak hour traffic volumes are shown in Figure 3.





WEEKDAY PM PEAK HOUR TRAFFIC VOLUMES  
[WEEKEND PEAK HOUR TRAFFIC VOLUMES]

Scale: 1"= 200'

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Date: October 2019



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**Figure 3**  
**Existing (2019) Peak Hour Traffic Volumes**  
**MJ's Market**  
**Grafton, Massachusetts**

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## **SAFETY ANALYSIS**

### **Crash Data**

Crash data for the study area was extracted from the MassDOT crash portal for the most recent three (3) year period of August 2016 through August 2019. Crash data was reviewed to determine the presence of safety concerns within the study area.

According to the data reviewed there were eleven (11) total incidents that occurred in the study area. Of these eleven (11) total incidents, three (3) incidents occurred on Westboro Road (Route 30), two (2) occurred on Pine Street, five (5) occurred at the intersection of Westboro Road at Pine Street, and one (1) on Centennial Drive. One (1) of these incidents resulted in a non-fatal injury, no fatalities were reported. A breakdown of the incidents by type and number of injuries can be seen below in Table 1. There were no trends or intensities of incidents noticed that would require or lend themselves to mitigation. A summary table of all crash data reviewed is provided in Appendix B.

***Table 1: Crash Summary***

<b>Roadway/ Intersection</b>	<b>Non- Fatal Injuries</b>	<b>Fatal Injuries</b>	<b>Angle</b>	<b>Loss of Control</b>	<b>Object</b>	<b>Rear End</b>	<b>Side Swipe</b>
<b>Westboro Road</b>	0	0	1	0	0	1	1
<b>Pine Street</b>	0	0	1	0	1	0	0
<b>Centennial Drive</b>	1	0	0	0	1	0	0
<b>Westboro Road &amp; Pine Street</b>	0	0	0	0	1	3	1

### **Site Circulation**

Circulation to and from the proposed marijuana facility is expected to mimic the existing traffic along the adjacent roadways. More specifically, all employees, deliveries/pick-ups and customers will enter the site via the driveway on Centennial Drive. Movements along these roadways interior to Centech Park have minimal traffic and little to no conflict. Therefore, the intersection of Centech Boulevard/Pine Street with Centennial Drive is considered the primary access point to the proposed facility from a traffic perspective.

### **Sight Distance**

A speed study was conducted along Centech Boulevard/Pine Street at Centennial Drive during the site visit on Tuesday October 1, 2019. The speeds along Centech Boulevard/Pine Street were high for an unposted area.

A summary of the speed data results is shown in Table 2. The complete speed data can be found in Appendix C.



**Table 2: Speed Data Results for Centech Boulevard/Pine Street**

	De Facto Speed	Average Speed	True Median (50 <sup>th</sup> Percentile)	85 <sup>th</sup> Percentile	10 MPH Pace	% over Posted
Northbound	30	32	31	40	27-36	53%
Southbound	30	34	34	38	30-39	73%

Based on the speed data obtained, a design speed of 40 miles per hour was selected for Centech Boulevard/Pine Street. According to the American Association of State Highway and Transportation Officials (AASHTO) publication *A Policy on the Geometric Design of Highways and Streets, Sixth Edition 2011*, the minimum safe stopping sight distance (SSD) for a 40 mile per hour speed is 305 feet. The minimum safe intersection sight distance (ISD) for turning vehicles from a minor street is 445 feet. A summary of the sight distance available at Centennial Drive can be seen below in Table 3.

**Table 3: Sight Distance Summary**

		Required SSD (ft)	Measured SSD (ft)	Required ISD (ft)	Measured ISD (ft)
Centennial Drive	To the North	305	410	445	410
	To the South	305	435	445	435

Sight distance both north and south of Centennial Drive is limited by the horizontal curvature of the roadway. The available sight distance in both directions is adequate for stopping sight distance but shy of the minimum intersection sight distance. According to AASHTO, if the intersection sight distances cannot be achieved, but the available sight distance is at least equal to the appropriate stopping sight distance, then drivers have sufficient sight distance to anticipate and avoid collisions.

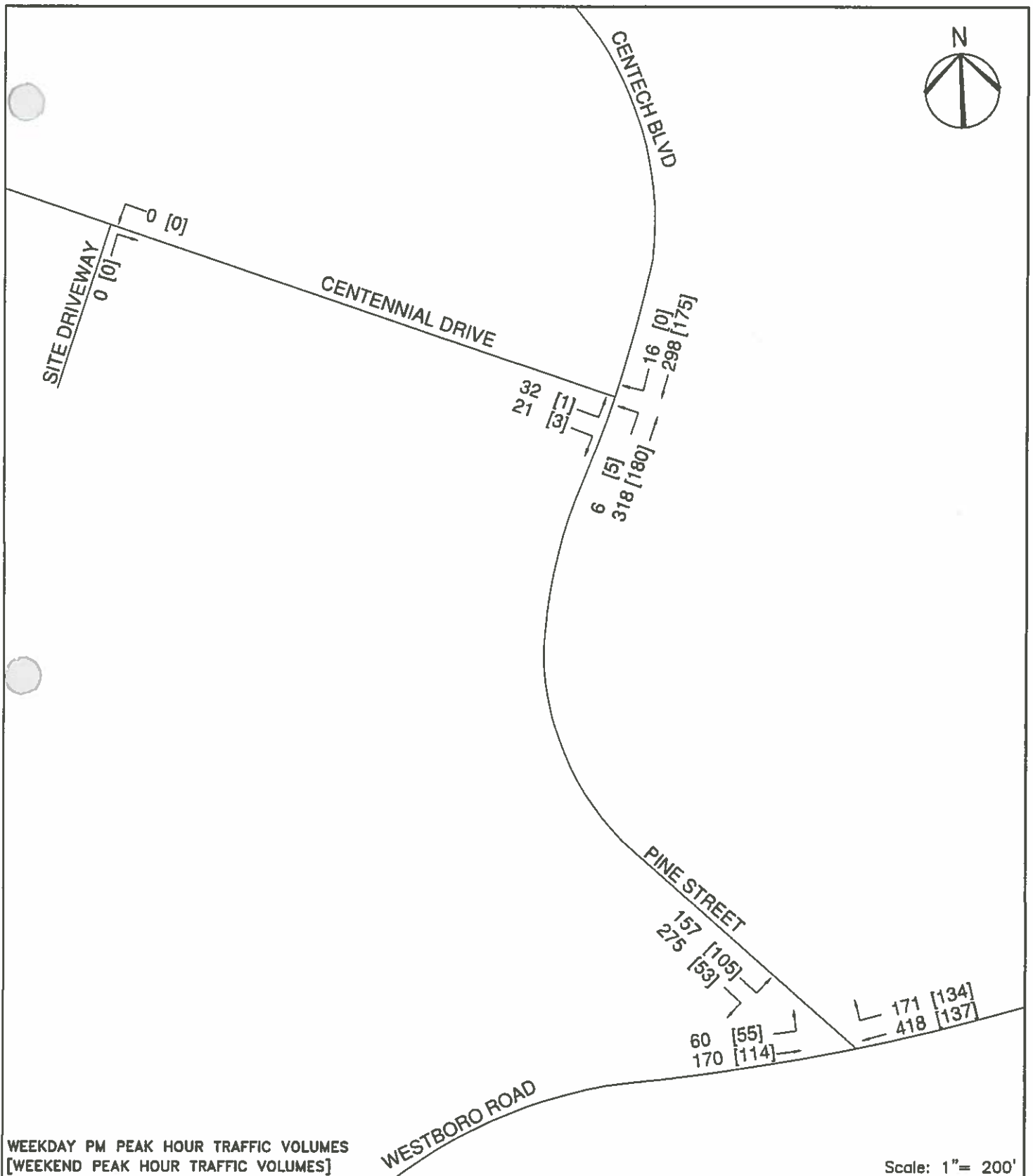
### **FUTURE CONDITIONS**

Future traffic volumes are determined by projecting the existing traffic volumes based on a determined annual growth rate. The Town of Grafton Planning Department was contacted to determine if there are currently any developments proposed within the vicinity of the site whose trip generation information should be included in the marijuana facility study. The Planning Department stated that Nature's Remedy medicinal marijuana cultivation/dispensary facility has been approved for development. Pare conducted the TIA for this project in 2017 and the site generated volumes for Nature's Remedy were included in the future (2026) no-build conditions.

To account for background growth along the roadways within the vicinity of the project site, the existing traffic volumes were projected over a seven-year horizon from 2019 to 2026. Recent census data was reviewed to determine the appropriate growth rate. The census data showed an average growth rate for the Town of almost 2.0% per year from 2000 to 2010. Based on this information, a growth rate of 2.0% per year was used for the seven-year projection.

A copy of the available census data is provided in Appendix D. Figure 4 provides the 2026 future no-build volumes for the p.m. and weekend peak hours.





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**Figure 4**  
**Future (2026) No-Build Peak Hour Traffic Volumes**

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## **BUILD CONDITIONS**

The future (2026) build condition represents the future (2026) no-build condition plus potential traffic expected from the proposed facility. The proposed facility has a total of 9,200 square feet with 2,000 square feet of recreational marijuana retail, 200 square feet of medical marijuana retail, a 1,000 square foot product manufacturing lab, and 6,000 square feet of marijuana cultivation. The facility is expected to have 10 full-time employees and an additional 30 part-time employees for cultivation.

### **Trip Generation**

Trip generation for the proposed development was completed using the industry standard Institute of Transportation Engineers (ITE) *Trip Generation, 10<sup>th</sup> Edition*<sup>1</sup>. The proposed development was analyzed with Land Use Code (LUC) 882: Marijuana Dispensary. LUC 882 was selected as being aligned with the proposed use, a facility used for the legal recreational distribution of marijuana, and the trip generation had volumes similar to what is expected by the property developers. ITE used trip generation data from marijuana dispensaries in Colorado and Oregon, where recreational marijuana use has been legal for a few years, to create the site generation model. It is expected that as marijuana dispensaries become more commonplace in Massachusetts the trip volumes will closely match the ITE trip generation model, though the novelty of the marijuana dispensary may lead to inflated volumes when it is first opened. The 2,000 square feet of recreational marijuana retail was used to determine the trip generation. The peak hours assessed are outside of the times employees are expected to arrive and leave; therefore, only the recreational retail space was for trip generation calculations. A summary of the proposed trip generation for the development is provided in Table 4.

**Table 4: Trip Generation Summary**

Land Use	Vehicles Trips Generated During Each Peak Hour		
	Weekday, PM Peak Hour	Weekday, Weekend Peak Hour	
LUC 882 – Marijuana Dispensary (2,000 sq. ft.)	Entering	22	36
	Exiting	22	36
	Total	44	72

### **Trip Distribution**

Trip distribution was completed for the proposed facility by adding the proposed traffic into the existing traffic stream based on the existing count volumes at each study area intersection. Tables 5 and 6 below show the existing trip distributions on Westboro Road (Route 30) and Pine Street/Centech Boulevard used to distribute the proposed traffic.

Complete trip distribution calculations are provided in Appendix E. The site-generated and future (2026) build volumes are shown in Figures 5 and 6 respectively.

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<sup>1</sup> Trip Generation, 10<sup>th</sup> Edition; Institute of Transportation Engineers; Washington, DC; 2017.



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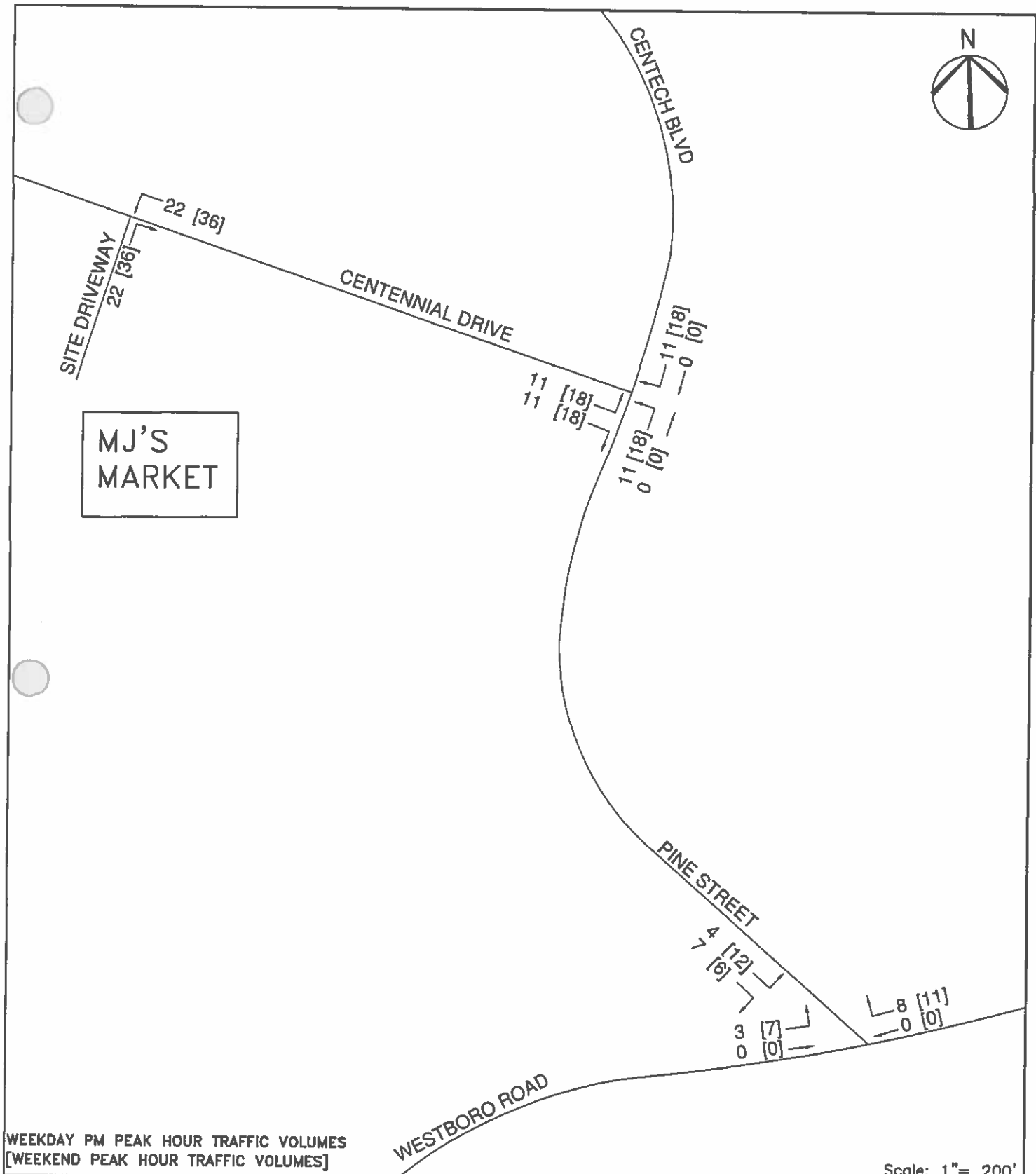
**Table 5: Trip Distribution for Westboro Road (Route 30)**

	<b>Westboro Road Westbound</b>	<b>Westboro Road Eastbound</b>
<b>PM Peak</b>	28%	72%
<b>Weekend Peak</b>	38%	62%

**Table 6: Trip Distribution for Pine Street/Centech Boulevard**

	<b>Pine Street/Centech Boulevard Northbound</b>	<b>Pine Street/Centech Boulevard Southbound</b>
<b>PM Peak</b>	51%	49%
<b>Weekend Peak</b>	51%	49%





Scale: 1" = 200'

Date: October 2019

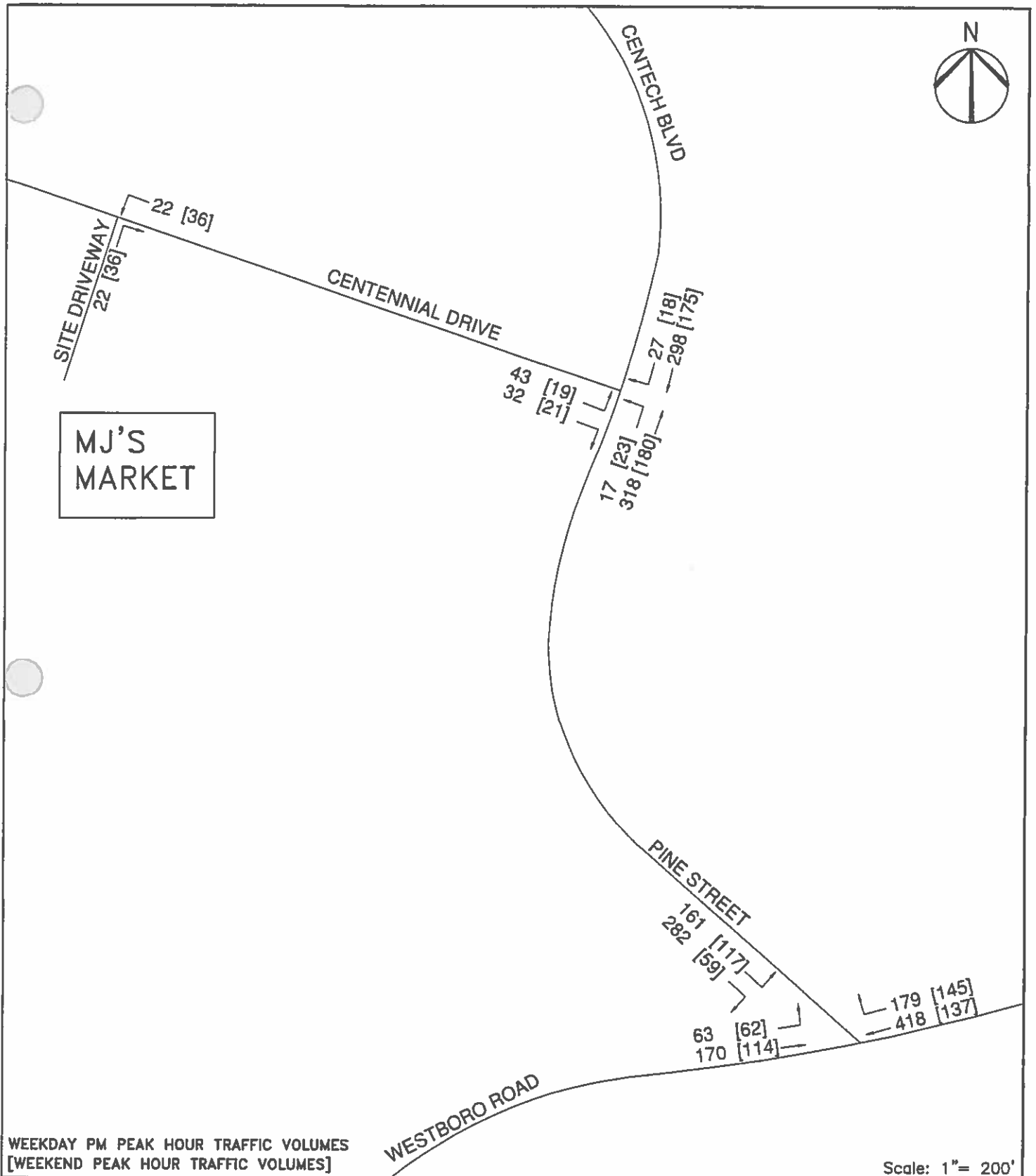


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**Figure 5**  
**Site Generated Peak Hour Traffic Volumes**

**MJ's Marker**  
**Grafton, Massachusetts**



WEEKDAY PM PEAK HOUR TRAFFIC VOLUMES  
[WEEKEND PEAK HOUR TRAFFIC VOLUMES]

Scale: 1" = 200'

Project No. 19156.00

Date: October 2019



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**Figure 6**  
**Future (2026) Build Peak Hour Traffic Volumes**  
**MJ's Market**  
**Grafton, Massachusetts**

## CAPACITY ANALYSIS

Capacity analysis was completed for all study intersections for existing, future (2026) no-build, and future (2026) build conditions. Capacity analysis characterizes intersections based on their level of service (LOS). LOS is a quality measure describing operational conditions within a traffic stream, generally in terms of service measures such as speed, travel times, traffic interruptions, etc. Six LOS, from A to F, are defined for each type of facility, with A representing the best operating conditions and F representing the worst operating conditions. The LOS criteria for unsignalized intersections are provided in Table 7 below. Tables 8 and 9 provide the capacity analysis results for all intersections for the a.m. and p.m. peak hours respectively. The complete capacity analyses can be found in Appendix F.

**Table 7: LOS Criteria for Unsignalized Intersections**

Unsignalized Intersection	
LOS	Delay Time (sec/veh)
A	0-10
B	> 10-15
C	> 15-25
D	> 25-35
E	> 35-50
F	> 50

**Table 8: PM Peak Hour LOS Table**

Intersection	Movement		Existing (2019)		Future (2026) No-Build		Future (2026) Build	
			LOS (Delay <sup>1</sup> )	Queue Length <sup>2</sup>	LOS (Delay <sup>1</sup> )	Queue Length <sup>2</sup>	LOS (Delay <sup>1</sup> )	Queue Length <sup>2</sup>
Westboro Road (Route 30) & Pine Street	EB	L, T	A (2.5)	8	A (2.5)	5	A (2.5)	5
	WB	T, R	A (0.0)	N/C	A (0.0)	N/C	A (0.0)	N/C
	SB	L, R	B (14.4)	90	C (15.0)	93	C (15.9)	100
Centech Boulevard & Centennial Drive	EB	L, R	B (12.9)	5	B (13.4)	10	B (14.1)	15
	NB	T, L	A (7.9)	0	A (7.9)	0	A (8.0)	0
	SB	T, R	A (0.0)	N/C	A (0.0)	N/C	A (0.0)	N/C

N/C – No Conflict

# - 95th percentile volume exceeds capacity; queue may be longer.

L - Left-turn; T - Through Movement; R - Right-turn

1. Delay is measured in seconds per vehicle.

2. Queue Length shown represents the 95th percentile queue length in feet.



**Table 9: Weekend Peak Hour LOS Table**

Intersection	Movement		Existing (2019)		Future (2026) No-Build		Future (2026) Build	
			LOS (Delay <sup>1</sup> )	Queue Length <sup>2</sup>	LOS (Delay <sup>1</sup> )	Queue Length <sup>2</sup>	LOS (Delay <sup>1</sup> )	Queue Length <sup>2</sup>
Westboro Road (Route 30) & Pine Street	EB	L, T	A (7.9)	3	A (8.0)	3	A (8.0)	5
	WB	T, R	A (0.0)	N/C	A (0.0)	N/C	A (0.0)	N/C
	SB	L, R	B (10.3)	18	B (10.8)	20	B (10.8)	23
Centech Boulevard & Centennial Drive	EB	L, R	A (9.5)	0	A (9.6)	0	B (10.6)	5
	NB	T, L	A (7.5)	0	A (7.6)	0	A (7.7)	3
	SB	T, R	A (0.0)	N/C	A (0.0)	N/C	A (0.0)	N/C

N/C – No Conflict

# - 95th percentile volume exceeds capacity; queue may be longer.

L - Left-turn; T - Through Movement; R - Right-turn

1. Delay is measured in seconds per vehicle.

2. Queue Length shown represents the 95th percentile queue length in feet.

Based on the analysis, the eastbound and westbound movements at the intersection of Westboro Road (Route 30) at Pine Street operate at LOS A under existing conditions and will remain at a LOS A under future (2026) no-build and build conditions, with minimal increase in delays and queues. The southbound movement at the intersection operates at a LOS B in both the p.m. and weekend existing peak hours. During the weekend peak hour the southbound movement remains at a LOS B in both future scenarios with minor increases in delay and queues. In the p.m. peak hour the southbound movement is expected to operate at a LOS C in the no-build and build scenarios. This is still a very high level of operation, with less than a second increase in delay between the no-build and build condition. This intersection experiences heavy southbound traffic during the p.m. commuter peak due to the proximity of the MBTA station.

The northbound and southbound movements at the intersection of Centech Boulevard at Centennial Drive operate at a LOS A in the existing conditions and the eastbound approach operates at a LOS B in the p.m. peak hour and a LOS A in the weekend peak hour. The northbound and southbound movements maintain a LOS A in both the future no-build and build conditions. In the p.m. peak hour the eastbound movement operates at a LOS B in both the no-build and build conditions, with a delay increase of less than 2 seconds and queue increase of no more than 10 feet. In the weekend peak hour the eastbound movement maintains a LOS A in the no-build scenario and a LOS B in the build scenario, with a 1 second increase in delay. Overall, the proposed development should have minimal impact on the intersection of Centech Boulevard at Centennial Drive.

## **CONCLUSIONS**

The crash data reviewed and summarized from August 2016 through August 2019 for the study area revealed a low frequency of incidents (less than 2 per year) at all study area intersections. All study area incidents, including this intersection, were of low severity with one (1) reported injury. There were no trends or concerns of incidents near the proposed facility that lend themselves to mitigation.

Sight distances reviewed for Centennial Drive at Centech Boulevard/Pine Street indicate that there is sufficient stopping sight distance in both directions, as well as adequate intersection sight



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distance for speeds up to 40 miles per hour to the north and south respectively, well over the defacto speed limit of 30 miles per hour.

Level of service and delay impacts at the intersection of Centech Boulevard at Centennial Drive within the study area are expected to be minor with all movements operating at a LOS A or B. The eastbound and westbound movements at the intersection of Westboro Road at Pine Street had minor level of service and delay impacts in both future scenarios. The southbound movement at the intersection deteriorated from a LOS B in existing conditions to a LOS C in the future no-build and the future build scenarios during the p.m. peak hour. Due to the proximity of the Centech office park, the intersection experiences high volumes during the p.m. commuter peak. No mitigation was determined to be necessary for this intersection.

In summary, the construction of the proposed medicinal and recreational marijuana dispensary is expected to have minimal impact on the traffic and safety operations within the study area, and no mitigation is necessary.

### **RECOMMENDATIONS**

Though the proposed medicinal marijuana facility is not expected to have any negative traffic or safety implications on the roadways within the study area, the Town could consider installing posted speed limit signs along Centech Boulevard/Pine Street to help reduce speeds in this area.



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## **Appendix A**

### **Traffic Counts**



**Transportation Data Corporation**  
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 tel (781) 587-0086 cell (781) 439-4999

Pine Street  
 E/W: Westboro Road (Route 30)  
 City, State: N. Grafton, MA  
 Client: Pare/A. Archer

File Name : 05244A  
 Site Code : 05244  
 Start Date : 9/28/2019  
 Page No : 1

Groups Printed- Cars & Peds - Trucks & Buses - Bikes by Direction

	Pine Street From North			Westboro Road (Route 30) From East			Westboro Road (Route 30) From West			
Start Time	Right	Left	Peds	Right	Thru	Peds	Thru	Left	Peds	Int. Total
11:00 AM	10	24	0	21	25	0	21	10	0	111
11:15 AM	12	23	0	37	30	0	25	10	0	137
11:30 AM	7	18	0	21	31	0	31	11	0	119
11:45 AM	16	25	0	30	31	0	23	15	0	140
Total	45	90	0	109	117	0	100	46	0	507
12:00 PM	11	25	0	29	27	0	20	12	0	124
12:15 PM	20	25	0	31	22	0	21	11	0	130
12:30 PM	9	22	0	29	27	0	27	6	0	120
12:45 PM	17	25	0	29	21	0	32	10	0	134
Total	57	97	0	118	97	0	100	39	0	508
Grand Total	102	187	0	227	214	0	200	85	0	1015
Apprch %	35.3	64.7	0	51.5	48.5	0	70.2	29.8	0	
Total %	10	18.4	0	22.4	21.1	0	19.7	8.4	0	
Cars & Peds	101	183	0	224	213	0	197	84	0	1002
% Cars & Peds	99	97.9	0	98.7	99.5	0	98.5	98.8	0	98.7
Trucks & Buses	1	2	0	1	0	0	1	0	0	5
% Trucks & Buses	1	1.1	0	0.4	0	0	0.5	0	0	0.5
Bikes by Direction	0	2	0	2	1	0	2	1	0	8
% Bikes by Direction	0	1.1	0	0.9	0.5	0	1	1.2	0	0.8

	Pine Street From North				Westboro Road (Route 30) From East				Westboro Road (Route 30) From West				
Start Time	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 11:00 AM to 12:45 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 11:15 AM													
11:15 AM	12	23	0	35	37	30	0	67	25	10	0	35	137
11:30 AM	7	18	0	25	21	31	0	52	31	11	0	42	119
11:45 AM	16	25	0	41	30	31	0	61	23	15	0	38	140
12:00 PM	11	25	0	36	29	27	0	56	20	12	0	32	124
Total Volume	46	91	0	137	117	119	0	236	99	48	0	147	520
% App. Total	33.6	66.4	0		49.6	50.4	0		67.3	32.7	0		
PHF	.719	.910	.000	.835	.791	.960	.000	.881	.798	.800	.000	.875	.929
Cars & Peds	45	88	0	133	115	118	0	233	98	47	0	145	511
% Cars & Peds	97.8	96.7	0	97.1	98.3	99.2	0	98.7	99.0	97.9	0	98.6	98.3
Trucks & Buses	1	2	0	3	1	0	0	1	0	0	0	0	4
% Trucks & Buses	2.2	2.2	0	2.2	0.9	0	0	0.4	0	0	0	0	0.8
Bikes by Direction	0	1	0	1	1	1	0	2	1	1	0	2	5
% Bikes by Direction	0	1.1	0	0.7	0.9	0.8	0	0.8	1.0	2.1	0	1.4	1.0

tel (781) 587-0086 cell (781) 439-4999

Client: Pare/A. Archer

Page No : 1

Group 1 - Cents - Cars & Peds - Trucks & Buses - Bikes by Direction										
	Centech Boulevard From North			Pine Street From South			Centennial Drive From West			
Start Time	Right	Thru	Peds	Thru	Left	Peds	Right	Left	Peds	Int. Total
11:00 AM	0	31	0	29	0	0	1	0	0	61
11:15 AM	1	34	0	49	0	0	1	0	0	85
11:30 AM	0	28	0	33	0	0	0	0	1	62
11:45 AM	0	38	0	44	1	0	0	0	1	84
Total	1	131	0	155	1	0	2	0	2	292
12:00 PM	0	32	0	40	2	0	0	0	0	74
12:15 PM	0	43	0	36	1	0	2	0	0	82
12:30 PM	0	34	0	41	0	0	0	1	0	76
12:45 PM	0	43	0	40	1	0	1	0	0	85
Total	0	152	0	157	4	0	3	1	0	317
Grand Total	1	283	0	312	5	0	5	1	2	609
Apprch %	0.4	99.6	0	98.4	1.6	0	62.5	12.5	25	
Total %	0.2	46.5	0	51.2	0.8	0	0.8	0.2	0.3	
Cars & Peds	1	277	0	308	5	0	5	1	2	599
% Cars & Peds	100	97.9	0	98.7	100	0	100	100	100	98.4
Trucks & Buses	0	3	0	1	0	0	0	0	0	4
% Trucks & Buses	0	1.1	0	0.3	0	0	0	0	0	0.7
Bikes by Direction	0	3	0	3	0	0	0	0	0	6
% Bikes by Direction	0	1.1	0	1	0	0	0	0	0	1

[illegible]

# Pare Corporation

8 Blackstone Valley Place  
Lincoln, RI 02865

www.parecorp.com

Nature's Remedy - Grafton, MA

Pare Project No: 17077.00

Recorded By: BP

Weather: Clear, Warm

File Name : centech-centen - afternoon

Site Code : 17077002

Start Date : 6/14/2017

Page No : 1

Groups Printed- Cars - Trucks														
	CENTECH BLVD From North				PINE ST From South				CENTENNIAL DR From West					
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total	
04:00 PM	3	46	0	49	54	2	0	56	4	4	3	11	116	
04:15 PM	3	47	0	50	44	1	0	45	3	3	1	7	102	
04:30 PM	1	51	0	52	47	1	0	48	5	3	0	8	108	
04:45 PM	2	63	0	65	59	0	0	59	1	7	0	8	132	
Total	9	207	0	216	204	4	0	208	13	17	4	34	458	
05:00 PM	2	76	0	78	69	1	0	70	6	2	0	8	156	
05:15 PM	2	56	0	58	51	0	0	51	2	2	0	4	113	
05:30 PM	0	54	0	54	87	1	0	88	3	6	0	9	151	
05:45 PM	2	46	0	48	52	1	0	53	2	4	0	6	107	
Total	6	232	0	238	259	3	0	262	13	14	0	27	527	
Grand Total	15	439	0	454	463	7	0	470	26	31	4	61	985	
Apprch %	3.3	96.7	0		98.5	1.5	0		42.6	50.8	6.6			
Total %	1.5	44.6	0	46.1	47	0.7	0	47.7	2.6	3.1	0.4	6.2		
Cars	14	431	0	445	451	6	0	457	24	29	4	57	959	
% Cars	93.3	98.2	0	98	97.4	85.7	0	97.2	92.3	93.5	100	93.4	97.4	
Trucks	1	8	0	9	12	1	0	13	2	2	0	4	26	
% Trucks	6.7	1.8	0	2	2.6	14.3	0	2.8	7.7	6.5	0	6.6	2.6	

	CENTECH BLVD From North				PINE ST From South				CENTENNIAL DR From West					
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total	
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1														
Peak Hour for Entire Intersection Begins at 04:45 PM														
04:45 PM	2	63	0	65	59	0	0	59	1	7	0	8	132	
05:00 PM	2	76	0	78	69	1	0	70	6	2	0	8	156	
05:15 PM	2	56	0	58	51	0	0	51	2	2	0	4	113	
05:30 PM	0	54	0	54	87	1	0	88	3	6	0	9	151	
Total Volume	6	249	0	255	266	2	0	268	12	17	0	29	552	
% App. Total	2.4	97.6	0		99.3	0.7	0		41.4	58.6	0			
PHF	.750	.819	.000	.817	.764	.500	.000	.761	.500	.607	.000	.806	.885	
Cars	6	244	0	250	261	2	0	263	12	16	0	28	541	
% Cars	100	98.0	0	98.0	98.1	100	0	98.1	100	94.1	0	96.6	98.0	
Trucks	0	5	0	5	5	0	0	5	0	1	0	1	11	
% Trucks	0	2.0	0	2.0	1.9	0	0	1.9	0	5.9	0	3.4	2.0	

# Pare Corporation

8 Blackstone Valley Place  
Lincoln, RI 02865

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Nature's Remedy - Grafton, MA  
Pare Project No: 17077.00  
Recorded By: MS  
Weather: Clear, Warm

File Name : westboro-pine - afternoon  
Site Code : 17077001  
Start Date : 6/14/2017  
Page No : 1

	Groups Printed- Cars - Trucks												
	PINE ST From North				WESTBORO RD From East				WESTBORO RD From West				
Start Time	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Int. Total
04:00 PM	29	26	0	55	40	71	0	111	26	12	0	38	204
04:15 PM	23	29	0	52	32	79	1	112	36	10	0	46	210
04:30 PM	33	23	0	56	30	75	0	105	31	19	0	50	211
04:45 PM	63	30	0	93	24	70	0	94	30	16	0	46	233
Total	148	108	0	256	126	295	1	422	123	57	0	180	858
05:00 PM	57	24	0	81	44	102	2	148	41	16	0	57	286
05:15 PM	25	41	0	66	34	97	1	132	48	7	0	55	253
05:30 PM	82	34	2	118	38	81	1	120	23	10	0	33	271
05:45 PM	18	30	0	48	42	56	0	98	29	12	0	41	187
Total	182	129	2	313	158	336	4	498	141	45	0	186	997
Grand Total	330	237	2	569	284	631	5	920	264	102	0	366	1855
Approch %	58	41.7	0.4		30.9	68.6	0.5		72.1	27.9	0		
Total %	17.8	12.8	0.1	30.7	15.3	34	0.3	49.6	14.2	5.5	0	19.7	
Cars	325	229	2	556	279	628	4	911	263	96	0	359	1826
% Cars	98.5	96.6	100	97.7	98.2	99.5	80	99	99.6	94.1	0	98.1	98.4
Trucks	5	8	0	13	5	3	1	9	1	6	0	7	29
% Trucks	1.5	3.4	0	2.3	1.8	0.5	20	1	0.4	5.9	0	1.9	1.6

	PINE ST From North				WESTBORO RD From East				WESTBORO RD From West					
Start Time	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Int. Total	
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1														
Peak Hour for Entire Intersection Begins at 04:45 PM														
04:45 PM	63	30	0	93	24	70	0	94	30	16	0	46	233	
05:00 PM	57	24	0	81	44	102	2	148	41	16	0	57	286	
05:15 PM	25	41	0	66	34	97	1	132	48	7	0	55	253	
05:30 PM	82	34	2	118	38	81	1	120	23	10	0	33	271	
Total Volume	227	129	2	358	140	350	4	494	142	49	0	191	1043	
% App. Total	63.4	36	0.6		28.3	70.9	0.8		74.3	25.7	0			
PHF	.692	.787	.250	.758	.795	.858	.500	.834	.740	.766	.000	.838	.912	
Cars	225	126	2	353	138	348	4	490	141	45	0	186	1029	
% Cars	99.1	97.7	100	98.6	98.6	99.4	100	99.2	99.3	91.8	0	97.4	98.7	
Trucks	2	3	0	5	2	2	0	4	1	4	0	5	14	
% Trucks	0.9	2.3	0	1.4	1.4	0.6	0	0.8	0.7	8.2	0	2.6	1.3	

---

## **Appendix B**

### **Crash Data**





Crash Ref No.	Report No.	Date	On Street	No. of Vehicles	Injuries	Fatalities	Weather Condition	Road Condition	Lighting	Crash Type
1	16-10-ac	1/12/16	WESTBORO ROAD / PINE STREET	2	0	0	Snow/Cloudy	Snow	Dark - lighted roadway	Angle
2	16-45-ac	2/16/16	WESTBORO ROAD / PINE STREET	2	0	0	Cloudy	Wet	Daylight	Angle
3	16-74-ac	4/5/16	WESTBORO ROAD Rte 30 E / PINE ST	2	0	0	Clear	Dry	Daylight	Angle
4	16-121-ac	6/12/16	PINE STREET	2	0	0	Clear	Dry	Dark - roadway not lighted	Angle
5	17-104-AC	6/22/17	WESTBORO RD	2	0	0	Clear	Dry	Daylight	Sideswipe, same direction
6	17-48-AC	3/10/17	WESTBORO RD	2	0	0	Snow/Cloudy	Snow	Daylight	Rear-end
7	17-49-AC	3/10/17	WESTBORO RD	2	0	0	Snow	Snow	Daylight	Angle
8	17-57-AC	3/27/17	CENTENNIAL DR / PINE ST	1	1	0	Cloudy	Wet	Dark - roadway not lighted	Single vehicle crash
9	17-157-AC	10/8/17	WESTBORO RD Rte 30 W / PINE ST	1	0	0	Rain/Cloudy	Wet	Daylight	Single vehicle crash
10	18-43-AC	3/1/18	WESTBORO RD Rte 30	2	0	0	Clear	Dry	Daylight	Rear-end
11	18-62-AC	3/23/18	WESTBORO RD Rte 30	2	0	0	Clear	Dry	Daylight	Sideswipe, opposite direction
12	18-63-AC	3/24/18	WESTBORO RD / PINE ST	2	0	0	Clear	Dry	Dark - roadway not lighted	Rear-end
13	18-76-AC	4/18/18	WESTBORO RD Rte 30 / PINE ST	2	0	0	Clear	Wet	Dark - lighted roadway	Front to Rear
14	2019-0C2-004044	5/30/19	PINE STREET Rte UNKNOW	2	0	0	Not Reported	Dry	Daylight	Angle
15	18-87-AC	5/28/18	PINE ST	1	0	0	Rain	Wet	Daylight	Single vehicle crash

---

## **Appendix C**

### **Speed Study**



# Pare Corporation

8 Blackstone Valley Place  
Lincoln, RI 02865

[www.parecorp.com](http://www.parecorp.com)

MJ's Market  
Taken By: KF  
Weather: Cloudy  
Centech Blvd @ Centennial Street

File Name : Centech Speed Study  
Site Code : 19156.00  
Start Date : 10/1/2019  
Page No : 1

#	Northbound	Southbound
1	28	37
2	25	32
3	36	26
4	45	43
5	42	38
6	36	36
7	27	33
8	27	30
9	28	28
10	22	33
11	28	30
12	31	30
13	30	34
14	29	36
15	35	26
16	42	33
17	28	42
18	28	24
19	30	33
20	36	32
21	29	37
22	41	38
23	32	38
24	37	31
25	26	45
26	31	37
27	32	39
28	36	28
29	33	34
30	40	36
31		

Class	Vehicle Count	85 Percentile	10 MPH Pace Speed	Number in Pace	Percent in Pace	True Median (50th Percentile)	Average Speed	Number of Vehicles Over 30 MPH	Percent of Vehicles Over 30 MPH	85 Percentile
Northbound	30	40	27 - 36	21	70	31	32	16	53	40
Southbound	30	38	30 - 39	22	73	34	34	22	73	38
Summary	60	38	28 - 37	40	67	33	33	38	63	38

---

## Appendix D

### Census Data



MJ's Market  
Grafton, MA  
Background Growth Rate  
Pare Project No. 19156.00  
October 1, 2019



**US Census Data  
Town of Grafton**

	Population
2010	17765
2000	14894
Years	10

ANNUAL GROWTH RATE	1.78%
--------------------	-------

SAY	2.00%
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## **Appendix E**

### **Trip Generation & Distribution**



MJ's Market  
 Grafton, MA  
 Trip Generation  
 PARE Project No. 19156.00  
 October 5, 2019



**Specialty Retail**  
**Land Use Code 882: Marijuana Dispensary**  
**Average Vehicle Trip Ends vs. 1,000 Sq. Feet Gross Floor Area**  
**Proposed: 2,000 Sq. Feet**

**On a: Weekday**

Average Rate:		2 * 252.7	506
Fitted Curve Equation:		N/A	N/A
Trips Entering	50% * 506		253
Trips Exiting	50% * 506		253
			<u>506</u>

**On a: Weekday, PM**  
**PM Peak Hour of Generator**

Average Rate:		2*21.83	44
Fitted Curve Equation:		N/A	N/A
Trips Entering	50% * 44		22
Trips Exiting	50% * 44		22
			<u>44</u>

**On a: Saturday**

Average Rate:		2 * 259.31	519
Fitted Curve Equation:		N/A	N/A
Trips Entering	50% * 519		259
Trips Exiting	50% * 519		259
			<u>518</u>

Trips

**On a: Saturday**  
**Peak Hour of Generator**

Average Rate:		2*36.43	72
Fitted Curve Equation:		N/A	N/A

Trips Entering	50% * 73	36
Trips Exiting	50% * 73	36
		<hr/> 72

2019-2026  
TRAFFIC VOLUME SUMMARY  
Future No-Build Growth Factor = 2.0%

Weekday PM Peak Hour  
4:45 - 5:45 PM

Weekend Peak Hour  
11:15 AM - 12:15 PM

Westboro Road & Pine Street							
	2017 Existing	2019 Existing	Bkgrd Devel.	2026 No-Build	Site Gen. (Enter)	Site Gen. (Exit)	2026 Build
SB - L	128	134	3	157	0	4	161
SB - R	227	236	4	275	0	7	282
EB - L	48	51	1	60	3	0	63
EB - T	142	148	0	170	0	0	170
WB - T	350	364	0	418	0	0	418
WB - R	140	146	3	171	8	0	179

Westboro Road & Pine Street							
	2019 Existing	Bkgrd Devel.	2026 No-Build	Site Gen. (Enter)	Site Gen. (Exit)	Site Generated	2026 Build
SB - L	81		105	0	7	12	117
SB - R	46		53	0	11	6	59
EB - L	48		55	7	0	7	62
EB - T	99		114	0	0	0	114
WB - T	118		137	11	0	0	137
WB - R	117		134	0	0	11	145

Centech Boulevard & Centennial Drive							
	2017 Existing	2019 Existing	Bkgrd Devel.	2026 No-Build	Site Gen. (Enter)	Site Gen. (Exit)	2026 Build
NB - L	2	2	4	6	11	0	17
NB - T	268	277	0	318	0	0	318
SB - T	248	259	0	296	0	0	296
SB - R	6	6	8	16	11	0	27
EB - L	17	18	11	32	0	11	43
EB - R	12	12	7	21	0	11	32

Centech Boulevard & Centennial Drive							
	2019 Existing	Bkgrd Devel.	2026 No-Build	Site Gen. (Enter)	Site Gen. (Exit)	Site Generated	2026 Build
NB - L	4		5	18	0	18	23
NB - T	157		180	0	0	0	180
SB - T	152		175	0	0	0	175
SB - R	0		0	18	0	18	18
EB - L	1		1	0	18	18	19
EB - R	3		3	0	18	18	21

---

**Appendix F**  
**Traffic Capacity Analysis**



Intersection						
Int Delay, s/veh	5.6					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↰	↑	↱		↰	↱
Traffic Vol, veh/h	51	148	364	146	134	236
Future Vol, veh/h	51	148	364	146	134	236
Conflicting Peds, #/hr	2	0	0	2	4	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Yield
Storage Length	0	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	84	84	83	83	76	76
Heavy Vehicles, %	8	1	1	1	2	1
Mvmt Flow	61	176	439	176	176	311

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	617	0	0	831	529
Stage 1	-	-	-	529	-
Stage 2	-	-	-	302	-
Critical Hdwy	4.18	-	-	6.42	6.21
Critical Hdwy Stg 1	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	5.42	-
Follow-up Hdwy	2.272	-	-	3.518	3.309
Pot Cap-1 Maneuver	934	-	-	340	552
Stage 1	-	-	-	591	-
Stage 2	-	-	-	750	-
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	932	-	-	317	551
Mov Cap-2 Maneuver	-	-	-	317	-
Stage 1	-	-	-	551	-
Stage 2	-	-	-	749	-

Approach	EB	WB	SB
HCM Control Delay, s	2.3	0	14.4
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	932	-	-	-	864
HCM Lane V/C Ratio	0.065	-	-	-	0.563
HCM Control Delay (s)	9.1	-	-	-	14.4
HCM Lane LOS	A	-	-	-	B
HCM 95th %tile Q(veh)	0.2	-	-	-	3.6

Intersection						
Int Delay, s/veh	0.7					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	W			W	W	
Traffic Vol, veh/h	18	12	2	277	259	6
Future Vol, veh/h	18	12	2	277	259	6
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	81	81	76	76	82	82
Heavy Vehicles, %	6	0	0	2	2	0
Mvmt Flow	22	15	3	364	316	7

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	690	320	323	0	-	0
Stage 1	320	-	-	-	-	-
Stage 2	370	-	-	-	-	-
Critical Hdwy	6.46	6.2	4.1	-	-	-
Critical Hdwy Stg 1	5.46	-	-	-	-	-
Critical Hdwy Stg 2	5.46	-	-	-	-	-
Follow-up Hdwy	3.554	3.3	2.2	-	-	-
Pot Cap-1 Maneuver	405	725	1248	-	-	-
Stage 1	727	-	-	-	-	-
Stage 2	690	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	404	725	1248	-	-	-
Mov Cap-2 Maneuver	404	-	-	-	-	-
Stage 1	725	-	-	-	-	-
Stage 2	690	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	12.9	0.1	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBTEBLn1	SBT	SBR
Capacity (veh/h)	1248	-	491	-
HCM Lane V/C Ratio	0.002	-	0.075	-
HCM Control Delay (s)	7.9	0	12.9	-
HCM Lane LOS	A	A	B	-
HCM 95th %tile Q(veh)	0	-	0.2	-

Intersection

Int Delay, s/veh 5.6

Movement EBL EBT WBT WBR SBL SBR

Lane Configurations	↖	↗	↖	↗	↖	↗
Traffic Vol, veh/h	60	170	418	171	157	275
Future Vol, veh/h	60	170	418	171	157	275
Conflicting Peds, #/hr	2	0	0	2	4	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Yield
Storage Length	0	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	8	1	1	1	2	1
Mvmt Flow	65	185	454	186	171	299

Major/Minor Major1 Major2 Minor2

Conflicting Flow All	642	0	-	0	868	549
Stage 1	-	-	-	-	549	-
Stage 2	-	-	-	-	319	-
Critical Hdwy	4.18	-	-	-	6.42	6.21
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.272	-	-	-	3.518	3.309
Pot Cap-1 Maneuver	914	-	-	-	323	537
Stage 1	-	-	-	-	579	-
Stage 2	-	-	-	-	737	-
Platoon blocked, %	-	-	-	-	-	-
Mov Cap-1 Maneuver	912	-	-	-	299	536
Mov Cap-2 Maneuver	-	-	-	-	299	-
Stage 1	-	-	-	-	537	-
Stage 2	-	-	-	-	736	-

Approach EB WB SB

HCM Control Delay, s	2.4	0	15
HCM LOS			C

Minor Lane/Major Mvmt EBL EBT WBT WBR SBLn1

Capacity (veh/h)	912	-	-	-	823
HCM Lane V/C Ratio	0.072	-	-	-	0.571
HCM Control Delay (s)	9.3	-	-	-	15
HCM Lane LOS	A	-	-	-	C
HCM 95th %tile Q(veh)	0.2	-	-	-	3.7

Intersection

Int Delay, s/veh 1.1

Movement EBL EBR NBL NBT SBT SBR

Lane Configurations	W			↑	↑	
Traffic Vol, veh/h	32	21	6	318	298	16
Future Vol, veh/h	32	21	6	318	298	16
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	6	0	0	2	2	0
Mvmt Flow	35	23	7	346	324	17

Major/Minor Minor2 Major1 Major2

Conflicting Flow All	693	333	341	0	-	0
Stage 1	333	-	-	-	-	-
Stage 2	360	-	-	-	-	-
Critical Hdwy	6.46	6.2	4.1	-	-	-
Critical Hdwy Stg 1	5.46	-	-	-	-	-
Critical Hdwy Stg 2	5.46	-	-	-	-	-
Follow-up Hdwy	3.554	3.3	2.2	-	-	-
Pot Cap-1 Maneuver	403	713	1229	-	-	-
Stage 1	717	-	-	-	-	-
Stage 2	697	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	400	713	1229	-	-	-
Mov Cap-2 Maneuver	400	-	-	-	-	-
Stage 1	712	-	-	-	-	-
Stage 2	697	-	-	-	-	-

Approach EB NB SB

HCM Control Delay, s	13.4	0.1	0
HCM LOS	B		

Minor Lane/Major Mvmt NBL NBTEBLn1 SBT SBR

Capacity (veh/h)	1229	-	484	-	-
HCM Lane V/C Ratio	0.005	-	0.119	-	-
HCM Control Delay (s)	7.9	0	13.4	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0	-	0.4	-	-

HCM 2010 TWSC  
2: Westboro Rd & Pine St

MJ's Market  
Build PM Peak

Intersection

Int Delay, s/veh 6

Movement EBL EBT WBT WBR SBL SBR

Lane Configurations	↖	↑	↗		↖	
Traffic Vol, veh/h	63	170	418	179	161	282
Future Vol, veh/h	63	170	418	179	161	282
Conflicting Peds, #/hr	2	0	0	2	4	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Yield
Storage Length	0	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	8	1	1	1	2	1
Mvmt Flow	68	185	454	195	175	307

Major/Minor Major1 Major2 Minor2

Conflicting Flow All	651	0	-	0	879	554
Stage 1	-	-	-	-	554	-
Stage 2	-	-	-	-	325	-
Critical Hdwy	4.18	-	-	-	6.42	6.21
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.272	-	-	-	3.518	3.309
Pot Cap-1 Maneuver	907	-	-	-	318	534
Stage 1	-	-	-	-	575	-
Stage 2	-	-	-	-	732	-
Platoon blocked, %	-	-	-	-	-	-
Mov Cap-1 Maneuver	905	-	-	-	293	533
Mov Cap-2 Maneuver	-	-	-	-	293	-
Stage 1	-	-	-	-	531	-
Stage 2	-	-	-	-	731	-

Approach EB WB SB

HCM Control Delay, s	2.5	0	15.9
HCM LOS			C

Minor Lane/Major Mvmt EBL EBT WBT WBR SBLn1

Capacity (veh/h)	905	-	-	-	806
HCM Lane V/C Ratio	0.076	-	-	-	0.597
HCM Control Delay (s)	9.3	-	-	-	15.9
HCM Lane LOS	A	-	-	-	C
HCM 95th %tile Q(veh)	0.2	-	-	-	4

Intersection

Int Delay, s/veh 1.6

Movement EBL EBR NBL NBT SBT SBR

Lane Configurations	W			↑	↑	
Traffic Vol, veh/h	43	32	17	318	298	27
Future Vol, veh/h	43	32	17	318	298	27
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	6	0	0	2	2	0
Mvmt Flow	47	35	18	346	324	29

Major/Minor Minor2 Major1 Major2

Conflicting Flow All	721	339	353	0	-	0
Stage 1	339	-	-	-	-	-
Stage 2	382	-	-	-	-	-
Critical Hdwy	6.46	6.2	4.1	-	-	-
Critical Hdwy Stg 1	5.46	-	-	-	-	-
Critical Hdwy Stg 2	5.46	-	-	-	-	-
Follow-up Hdwy	3.554	3.3	2.2	-	-	-
Pot Cap-1 Maneuver	388	708	1217	-	-	-
Stage 1	713	-	-	-	-	-
Stage 2	681	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	381	708	1217	-	-	-
Mov Cap-2 Maneuver	381	-	-	-	-	-
Stage 1	700	-	-	-	-	-
Stage 2	681	-	-	-	-	-

Approach EB NB SB

HCM Control Delay, s	14.1	0.4	0
HCM LOS	B		

Minor Lane/Major Mvmt NBL NBTEBLn1 SBT SBR

Capacity (veh/h)	1217	-	475	-	-
HCM Lane V/C Ratio	0.015	-	0.172	-	-
HCM Control Delay (s)	8	0	14.1	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0	-	0.6	-	-

HCM 2010 TWSC  
2: Westboro Rd & Pine St

MJ's Market  
Existing Weekend Peak

Intersection						
Int Delay, s/veh	3.5					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↖	↑	↗		↖	
Traffic Vol, veh/h	48	99	119	117	91	46
Future Vol, veh/h	48	99	119	117	91	46
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Yield
Storage Length	0	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	88	88	88	88	84	84
Heavy Vehicles, %	0	0	1	0	2	2
Mvmt Flow	55	113	135	133	108	55

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	268	0	0 425 202
Stage 1	-	-	- 202 -
Stage 2	-	-	- 223 -
Critical Hdwy	4.1	-	- 6.42 6.22
Critical Hdwy Stg 1	-	-	- 5.42 -
Critical Hdwy Stg 2	-	-	- 5.42 -
Follow-up Hdwy	2.2	-	- 3.518 3.318
Pot Cap-1 Maneuver	1307	-	- 586 839
Stage 1	-	-	- 832 -
Stage 2	-	-	- 814 -
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	1307	-	- 561 839
Mov Cap-2 Maneuver	-	-	- 561 -
Stage 1	-	-	- 797 -
Stage 2	-	-	- 814 -

Approach	EB	WB	SB
HCM Control Delay, s	2.6	0	10.3
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1307	-	-	-	845
HCM Lane V/C Ratio	0.042	-	-	-	0.193
HCM Control Delay (s)	7.9	-	-	-	10.3
HCM Lane LOS	A	-	-	-	B
HCM 95th %tile Q(veh)	0.1	-	-	-	0.7

Intersection

Int Delay, s/veh 0.3

Movement EBL EBR NBL NBT SBT SBR

Lane Configurations	Y			↑	↑	
Traffic Vol, veh/h	1	3	4	157	152	0
Future Vol, veh/h	1	3	4	157	152	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	50	50	96	96	88	88
Heavy Vehicles, %	0	0	0	1	0	0
Mvmt Flow	2	6	4	164	173	0

Major/Minor Minor2 Major1 Major2

Conflicting Flow All	345	173	173	0	-	0
Stage 1	173	-	-	-	-	-
Stage 2	172	-	-	-	-	-
Critical Hdwy	6.4	6.2	4.1	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.2	-	-	-
Pot Cap-1 Maneuver	656	876	1416	-	-	-
Stage 1	862	-	-	-	-	-
Stage 2	863	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	654	876	1416	-	-	-
Mov Cap-2 Maneuver	654	-	-	-	-	-
Stage 1	859	-	-	-	-	-
Stage 2	863	-	-	-	-	-

Approach EB NB SB

HCM Control Delay, s	9.5	0.2	0
HCM LOS	A		

Minor Lane/Major Mvmt NBL NBTEBLn1 SBT SBR





Capacity (veh/h)	1416	-	807	-	-
HCM Lane V/C Ratio	0.003	-	0.01	-	-
HCM Control Delay (s)	7.5	0	9.5	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

HCM 2010 TWSC  
2: Westboro Rd & Pine St

MJ's Market  
No Build Weekend Peak

Intersection

Int Delay, s/veh 3.6

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	55	114	137	134	105	53
Future Vol, veh/h	55	114	137	134	105	53
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Yield
Storage Length	0	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	0	1	0	2	2
Mvmt Flow	60	124	149	146	114	58

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	295	0	0 466 222
Stage 1	-	-	- 222 -
Stage 2	-	-	- 244 -
Critical Hdwy	4.1	-	- 6.42 6.22
Critical Hdwy Stg 1	-	-	- 5.42 -
Critical Hdwy Stg 2	-	-	- 5.42 -
Follow-up Hdwy	2.2	-	- 3.518 3.318
Pot Cap-1 Maneuver	1278	-	- 555 818
Stage 1	-	-	- 815 -
Stage 2	-	-	- 797 -
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	1278	-	- 529 818
Mov Cap-2 Maneuver	-	-	- 529 -
Stage 1	-	-	- 777 -
Stage 2	-	-	- 797 -

Approach	EB	WB	SB
HCM Control Delay, s	2.6	0	10.8
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1278	-	-	-	796
HCM Lane V/C Ratio	0.047	-	-	-	0.216
HCM Control Delay (s)	8	-	-	-	10.8
HCM Lane LOS	A	-	-	-	B
HCM 95th %tile Q(veh)	0.1	-	-	-	0.8

**Intersection**

Int Delay, s/veh 0.2

**Movement** EBL EBR NBL NBT SBT SBR

Lane Configurations	W			4	1	
Traffic Vol, veh/h	1	3	5	180	175	0
Future Vol, veh/h	1	3	5	180	175	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	1	0	0
Mvmt Flow	1	3	5	196	190	0

**Major/Minor** Minor2 Major1 Major2

Conflicting Flow All	396	190	190	0	-	0
Stage 1	190	-	-	-	-	-
Stage 2	206	-	-	-	-	-
Critical Hdwy	6.4	6.2	4.1	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.2	-	-	-
Pot Cap-1 Maneuver	613	857	1396	-	-	-
Stage 1	847	-	-	-	-	-
Stage 2	833	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	611	857	1396	-	-	-
Mov Cap-2 Maneuver	611	-	-	-	-	-
Stage 1	844	-	-	-	-	-
Stage 2	833	-	-	-	-	-

**Approach** EB NB SB

HCM Control Delay, s	9.6	0.2	0
HCM LOS	A		

**Minor Lane/Major Mvmt** NBL NBT EBLn1 SBT SBR

Capacity (veh/h)	1396	-	779	-	-
HCM Lane V/C Ratio	0.004	-	0.006	-	-
HCM Control Delay (s)	7.6	0	9.6	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

HCM 2010 TWSC  
2: Westboro Rd & Pine St

MJ's Market  
Build Weekend Peak

Intersection

Int Delay, s/veh 3.7

Movement EBL EBT WBT WBR SBL SBR

Lane Configurations	↖	↑	↗		↖	
Traffic Vol, veh/h	59	117	137	145	112	64
Future Vol, veh/h	59	117	137	145	112	64
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Yield
Storage Length	0	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	0	1	0	2	2
Mvmt Flow	64	127	149	158	122	70

Major/Minor Major1 Major2 Minor2

Conflicting Flow All	307	0	-	0	483	228
Stage 1	-	-	-	-	228	-
Stage 2	-	-	-	-	255	-
Critical Hdwy	4.1	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.2	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1265	-	-	-	542	811
Stage 1	-	-	-	-	810	-
Stage 2	-	-	-	-	788	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1265	-	-	-	514	811
Mov Cap-2 Maneuver	-	-	-	-	514	-
Stage 1	-	-	-	-	769	-
Stage 2	-	-	-	-	788	-

Approach EB WB SB

HCM Control Delay, s	2.7	0	10.8
HCM LOS			B

Minor Lane/Major Mvmt EBL EBT WBT WBR SBLn1

Capacity (veh/h)	1265	-	-	-	808
HCM Lane V/C Ratio	0.051	-	-	-	0.237
HCM Control Delay (s)	8	-	-	-	10.8
HCM Lane LOS	A	-	-	-	B
HCM 95th %tile Q(veh)	0.2	-	-	-	0.9

### Intersection

Int Delay, s/veh 1.4

### Movement

	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	W			↑	↑	
Traffic Vol, veh/h	19	21	23	180	175	18
Future Vol, veh/h	19	21	23	180	175	18
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	1	0	0
Mvmt Flow	21	23	25	196	190	20

### Major/Minor

	Minor2	Major1	Major2
Conflicting Flow All	446	200	210
Stage 1	200	-	-
Stage 2	246	-	-
Critical Hdwy	6.4	6.2	4.1
Critical Hdwy Stg 1	5.4	-	-
Critical Hdwy Stg 2	5.4	-	-
Follow-up Hdwy	3.5	3.3	2.2
Pot Cap-1 Maneuver	574	846	1373
Stage 1	838	-	-
Stage 2	800	-	-
Platoon blocked, %			
Mov Cap-1 Maneuver	563	846	1373
Mov Cap-2 Maneuver	563	-	-
Stage 1	821	-	-
Stage 2	800	-	-

### Approach

	EB	NB	SB
HCM Control Delay, s	10.6	0.9	0
HCM LOS	B		

### Minor Lane/Major Mvmt

	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1373	-	683	-	-
HCM Lane V/C Ratio	0.018	-	0.064	-	-
HCM Control Delay (s)	7.7	0	10.6	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0.1	-	0.2	-	-